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The genus *Craspedoxantha* Bezzi (Diptera: Tephritidae: Terelliinae)

by

Amnon Freidberg

(Department of Zoology, The George S. Wise Faculty of Life Sciences, Tel Aviv University, Tel Aviv 69978, Israel)

ABSTRACT

The genus *Craspedoxantha* Bezzi is revised. It contains 9 species, of which 3 are new (*C. milleri*, *C. vernoniae* and *C. yaromi*). Seven species, including the new ones, are Afrotropical, and two are Oriental. Host records are provided where available, all within the family Compositae. *C. marginalis* is a pest of garden flowers (daisies, zinnias, etc.) in South Africa. The phylogenetic relationships of *Craspedoxantha* within the Terelliinae are discussed, and keys to the genera of Terelliinae and species of *Craspedoxantha* are provided.

INTRODUCTION

This study was initiated in 1979 as part of a post-doctoral project aimed at a revision of the subfamily Terelliinae. It was held in abeyance until recently, when I was able to borrow most of the pertinent holotypes and to study many more specimens, including those of three undescribed species. This is the first of a series of revisionary studies in the subfamily Terelliinae. A diagnosis of the subfamily, and a key to all genera is provided. Terminology essentially follows that of McAlpine (1981).

I am indebted to the following Institutions and curators for the loan of material:

BMNH—British Museum (Natural History), London, England (Mr B. H. Cogan).
BPBM —Bernice P. Bishop Museum, Honolulu, Hawaii, USA (Dr D. E. Hardy).
CAS —California Academy of Sciences, San Francisco, California, USA (Dr P. H. Arnaud, Jr.).
CNC —Canadian National Collection, Agriculture Canada, Ottawa, Ontario, Canada (Dr J. F. McAlpine).
MNHP—Museum National d'Histoire Naturelle, Paris, France (Dr L. Matile).
MSNM—Museo Civico di Storia Naturale, Milan, Italy (Dr C. Leonardi).
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TAU —Tel Aviv University, Tel Aviv, Israel.
USNM—National Museum of Natural History, Smithsonian Institution, Washington D.C., USA (Dr R. H. Foote).
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TAXONOMY

Subfamily Terelliinae Hendel

Terelliini Hendel, 1927:21 (as tribe of Tephritinae)—Terelliinae Hering, 1947:15

Diagnosis: Two upper and three lower concolorous orbital bristles present; anterior upper orbital somewhat eclinate; posterior upper orbital inclinate. Postocular bristles acuminate and usually white to yellow; some postoculars sometimes brown or black. Frontal strips usually bare (hairy in some *Neaspilota*). Arista usually with short hairs. Proboscis capitate.

Scutum almost invariably with dark lyre-like pattern. One pair of dorsocentral bristles usually present, inserted between line of anterior supra-alars and suture or, rarely, on suture or posterior of line of anterior supra-alars; an additional presutural pair sometimes present (*Chaetorellia*). Scutellum with 4 subequal bristles. Wing banded, spotted or hyaline. Vein R_{4+5} bare, or with few setulae dorsally and ventrally at node, rarely with additional setulae on proximal and distal sections. Cell *cup* with short or long posteroapical point.

Tergite 6 of female usually distinctly longer than T5. Aedeagal glans usually strongly sclerotised, with distinct tube-like structures and with isolated rod in vesica.

Head and abdomen slightly microtomentose; microtomentum (= pruinosity, dust) on thorax mainly distinct on darker areas.

Host-plants: Compositae, mostly of the tribe Cynareae. The larvae of most species live and pupate in the flower head; those of some species bore in stems or pupate outside the plant.

Distribution: Palaearctic, Nearctic, Oriental and Afrotropical.

Discussion: It is widely accepted by dipterists that the suprageneric classification of the Tephritidae is far from being settled, and the status of the Terelliinae is no exception. Hendel (1927) first used the name Terelliini as a tribe of Tephritinae. Hering (1947), in the only suprageneric key with a world-wide basis, raised the Terelliini to a subfamily rank, and was followed by Munro (1957:888). However, recently Foote (1980:9) and Cogan & Munro (1980:551) considered this taxon a tribe of the Tephritinae. I prefer to treat it as a subfamily primarily because of its unique apomorphic character, namely the inclination of the upper orbital bristles (anterior one eclinate and reclinate, posterior one inclinate). Outside this group this condition occurs only in *Paraterellia* Foote, a frugivorous, Nearctic genus, which is undoubtedly a trypetine. The dark lyre-like pattern on the thorax is also a good apomorphic character. However, in very lightly coloured species it is sometimes indistinct. Also, based on the main character used to distinguish the Tephritinae from the Trypetinae, ie. the colour and shape of the postocular bristles (eg. Hardy 1973:7), the terelliines cannot be placed properly in either subfamily and form an intermediate group. Most tephritines have at least some white or yellowish lanceolate bristles in the postocular row, while in most trypetines this row is composed of black (or otherwise dark), acuminate bristles. In the terelliines the bristles in this row are acuminate and yellowish, sometimes mixed with black ones. Other characters, such as the position of the dorsocentral bristles, the amount of body microtomentum and the relative length of the female's tergites, are also in accordance with the intermediate position of the group. In another paper (Freidberg 1984) I have discussed the possibility that the Terelliinae is the sister group of the Myopitinae (= Urophorinae = Euribiinae), a taxon traditionally treated as a tribe of the Trypetinae (Hendel 1927, Hardy 1973). This is in accordance with my view that all tribes or subfamilies in the Tephritidae, the larvae of which feed exclusively on plants of the family Compositae ('the tephritine stock'), have a common ancestor, which is not common to them and to the frugivorous taxa ('the trypetine stock'). The few known exceptions, such as those trypetines breeding in Compositae, could perhaps be used to indicate possible relationships between the two stocks. The aciurines, with hosts in the Labiatae, Acanthaceae and Verbenaceae, all plant families rather closely related to the Compositae, seem to be more closely related to the tephritine stock than to the trypetine stock. Morphologically, the aciurines, like the terelliines, form an intermediate group between the two main stocks.

The following key deals with eight genera. It does not include *Squamensina* Hering which was synonymised with *Orellia* (Foote & Freidberg 1980:31), but it does include *Galada* Hering which could not be separated from *Orellia*, but has not yet been synonymised with it.

Key to the genera of Terelliinae

1 Antennae widely separated at base; face distinctly concave; antennal pedicel in male with a long, internal, setulose projection, in female with moderately strong setulae (west Palaearctic) .... **Cerajocera** Rondani

— Antennae and face not as above 2

2 Two pairs of dorsocentral bristles present (presutural and postsutural); wing with 4 transverse bands; lower calypter at most as long as upper calypter (Palaearctic) .... **Chaetorellia** Hendel

— Only one pair (postsutural) dorsocentral bristles present (however, *Orellia blanda* Richter from Asia has two pairs of dorsocentral bristles); wing pattern variable, sometimes lacking; lower calypter as long as upper or longer.... 3

3 Anterior part of gena ('vibrissal corner') with some (usually 3–6) strong, dark bristles; mediotergite shiny; both calypteres of the same length; wing with 4 transverse bands (Holarctic) .... **Chaetostomella** Hendel

— Anterior part of gena without such bristles; mediotergite usually matt; lower calypter usually longer than upper calypter 4

4 Scutellum with at least some blackish setulae; eye 1½–2 times as high as long (Fig. 1); wing with a complete yellow costal band, spotted with black, usually with cell *cup* yellow and sometimes with an additional oblique or transverse band (Afrotropical and Oriental) .... **Craspedoxantha** Bezzi

— Scutellum with whitish setulae only; eye usually less than 1½ times as high as long; wing entirely hyaline or with a different pattern 5

5 Foretarsus of male modified, with asymmetrical claws; frontal stripe in some species distinctly pubescent; small species, usually well below 5 mm in length (Nearctic) .... **Neaspilota** Osten Sacken

— Foretarsus of male normal, with symmetrical claws; frontal stripe bare; length usually 5 mm or more 6

6 Wing usually entirely hyaline, sometimes somewhat infuscated; abdominal setulae mainly whitish; mid- and hind femur posteroventrally without bristles; apical section of vein M usually at least twice as long as penultimate section (west Palaearctic) .... **Terellia** Robineau-Desvoidy

— Wing usually with transverse bands or spots; when hyaline, then abdominal setulae brown or black, and apical section of vein M less than twice as long as penultimate section; mid- and hind femur often with posteroventral bristles (predominantly Holarctic, with a few species penetrating into the Oriental and Neotropical regions) .... **Orellia** Robineau-Desvoidy & **Galada** Hering

Genus *Craspedoxantha* Bezzi

Craspedoxantha Bezzi 1913:156 (type-species *Craspedoxantha octopunctata* Bezzi, by original designation); Hendel, 1914:91 (key to world genera of Tephritidae); Hardy, 1973:316 (discussion).

Description: Specimens relatively large, ♂ 4–7 mm, ♀ 5–9 mm, green in life, predominantly yellow after death.

Head (Fig. 1): Distinctly higher than long; fronto-facial angle 100°–120°; lower facial margin projecting; eye about twice as high as long; gena narrower than, or as

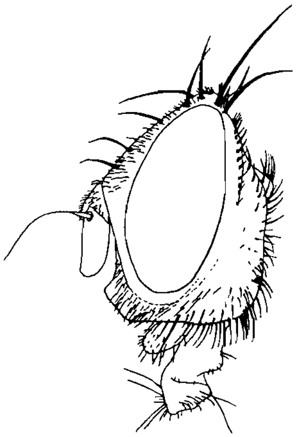
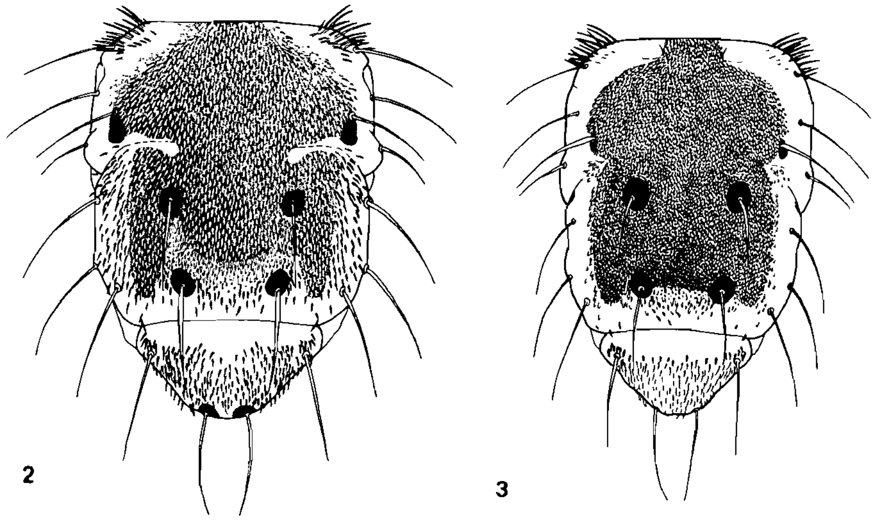


Fig. 1 *Craspedoxantha marginalis* (Wiedemann), head, profile.

wide as antenna; antenna slightly shorter than face; 1st flagellomere 1,5–2,5 times as long as wide; palpus short and broad.

Thorax (Figs 2–3): 1–2 anepisternal bristles; dorsocentral bristles aligned with anterior supra-alar bristles or half way between them and transverse suture; scutum with the usual lyre-like pattern densely covered by short, adpressed, white or yellow scale-like setulae and fine, grey microtomentum; four large, round, shiny black spots around insertations of dorsocentral and prescutellar bristles devoid of this vestiture; four additional black spots present laterally at either side and distributed as follows: posterior of base of presutural bristles, lateral of base of anterior supra-alar bristle, posterior of wing base and anterior of scutellar corner; scutellum slightly convex, with some or many blackish setulae at least on apical half, sometimes almost entirely covered by blackish setulae, with or without whitish setulae basally, with or without black spots around insertations of bristles; pleura usually not striated, shiny, lightly microtomentose; katepisternum, katepimeron and laterotergite with dark, more heavily microtomentose areas; both calypteres wide, not linear.

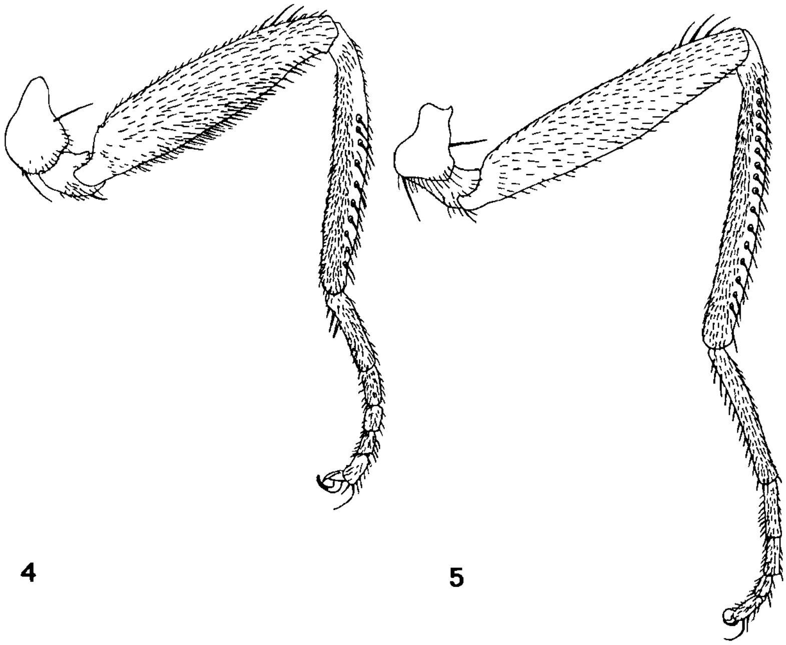


Figs 2–3. *Craspedoxantha* spp., thorax, dorsal view. 2. *C. marginalis* (Wiedemann). 3. *C. vernoniae* sp. n.

Legs (Figs 4–5): Turgid or rather elongate, hind femur dorsally preapically with a group of bristles; all femora ventrally with or without short, dark, bristly setulae or hairs, which, when present, are denser on hind femur.

Wing (Figs 6–13): Elongate (length:width ratio 2,7:1–3:1), with elongate stigma (length:width ratio about 3:1); apical section of vein M more than twice as long as penultimate section (usually 2,2:1–3:1); point of cell *cup* moderately long, wing pattern composed of a yellow costal band, spotted with black, extending from base of wing to end of vein M or slightly beyond it; in addition, cell *cup* is more or less yellow. An additional, transverse or oblique band is present in some species.

Abdomen: Predominantly dull yellow, with black pattern and some shiny areas; T1



Figs 4–5. *Craspedoxantha* spp., left hind leg. 4. *C. marginalis* (Wiedemann). 5. *C. vernoniae* sp. n.

with yellowish pubescence, abdomen otherwise partly or entirely clothed by blackish setulae. ♂ with a pair of small black spots on anterior margin of T3 and T4, sometimes lacking, and with a pair of similar spots on posterior margin of T5, lateral of the terminalia; T5 along anterior margin with a black band, often interrupted in the middle. T2, lateral margins of all tergites, the black band on T5 (which is lightly microtomentose), posterior $\frac{1}{3}$ of T5 and narrow posterior margin of T3 and T4 shiny. ♀ with a pair of small black spots on anterior margin of T4–T6 and laterobasally on oviscape; apex of oviscape usually also black; shiny pattern generally similar to ♂, except on T6, where it occupies more or less posterior half of tergite.

Terminalia (Figs 14–43): ♂: Epandrium (Figs 14–25) oval or rounded, with short outer surstyli. Glans of aedeagus strongly sclerotised (Figs 26–29), with a sclerotised rod apically in the vesica, short tubes centrally and short or long, pointed projection basally. ♀: 2 spermathecae present; sclerotised surface usually with finger-like projections. Spermathecal duct enlarges distally, forming an elongate container (Figs 30–36). Aculeus flattened dorsoventrally, subapically with 3 pairs of setulae and other structures (sensilla?) (Figs 37–43).

Key to species of *Craspedoxantha*

1 Scutellum with black spots (Fig. 2); 2 anepisternal bristles; legs short, turgid (Fig. 4); femora ventrally densely setulose, especially in male; dorsocentral bristles aligned with anterior supra-alar bristles (Afrotropical; *marginalis* species group) 2

— Scutellum unspotted; 1 anepisternal bristle; legs elongate (Fig. 5); femora ventrally not densely setulose; dorsocentral bristles usually aligned about halfway between anterior supra-alar bristles and suture (in *octopunctata* dorsocentral bristles aligned with anterior supra-alar bristles) (Afrotropical and Oriental; *manengubae* species group) 5

2 Scutellum with 2 black spots, around bases of apical scutellar bristles 3

— Scutellum with 4 black spots, around bases of all scutellar bristles 4

3 Apical spots of scutellum fused to form a single, broad, black spot (South Africa) . . . . **unimaculata** Bezzi

— Apical spots of scutellum separated (widespread, from Sudan to Gambia and to South Africa) . . . . **marginalis** (Wiedemann)

4 Wing pattern with a transverse, zigzag band over r-m and dm-cu crossveins (Fig. 9); apical spots of scutellum very large, touching; lyre-like pattern on scutum at least partly black (South Africa) . . . . **milleri** sp. n.

— Wing pattern without a transverse band; apical spots of scutellum well separated; lyre-like pattern on scutum yellow, indistinct (Kenya, Zaïre, Zimbabwe, Gambia, Malaŵi) . . . . **polyspila** Bezzi

5 Cell *cup* in the wing distinctly yellow (Fig. 6); presutural black spots about as large as dorsocentral spots (Oriental) 6

— Cell *cup* in the wing very slightly and indistinctly yellow (Fig. 13); presutural black spots distinctly smaller than dorsocentral spots (Afrotropical) 7

6 Wing with a yellow band from cell *cup*, over vein CuA_1, to posterior wing margin (Fig. 10) (Burma, Vietnam) . . . . **octopunctata** Bezzi

— Wing without such a band, only with cell *cup* yellow (Fig. 6) (Pakistan, India) **indica** Zaka-ur-Rab

7 Small, light-yellow species; wing length 4,5–5 mm; setulae on scutellum almost entirely whitish, only a few at posterior margin blackish; female's aculeus short and broad, tapering abruptly (Fig. 43) (Kenya, Tanzania) . . . . . **yaromi** sp. n.

— Larger and darker species; wing length 5,5–8 mm; setulae on scutellum almost entirely blackish; female's aculeus more elongate, tapering gradually (Figs 38, 42) 8

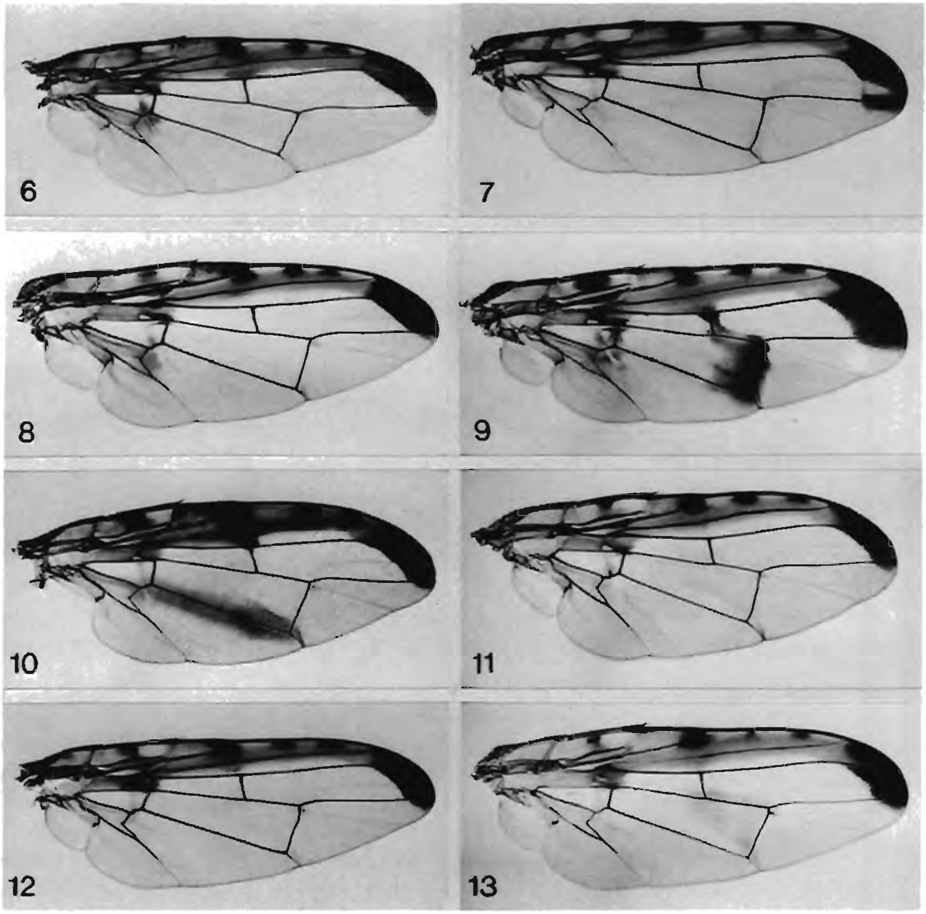
8 Yellow marginal band of wing distinctly widens opposite r-m crossvein, almost reaching vein R_{4+5} (Fig. 12); the band ends at wing tip in a narrow, blackish spot which is $\frac{1}{5}$–$\frac{1}{4}$ as wide as length of apical section of vein M (Ethiopia south to Malaŵi) . . . . **vernoniae** sp. n.

— Yellow marginal band of wing evenly narrow, not approaching vein R_{4+5} (Fig. 7), ending at wing tip in a blackish spot that broadens in cell r_{4+5}, and is $\frac{1}{4}$–$\frac{1}{3}$ as wide as length of apical section of vein M, often enclosing a hyaline spot (Cameroon) . . . . **manengubae** Speiser

Craspedoxantha indica Zaka-ur-Rab

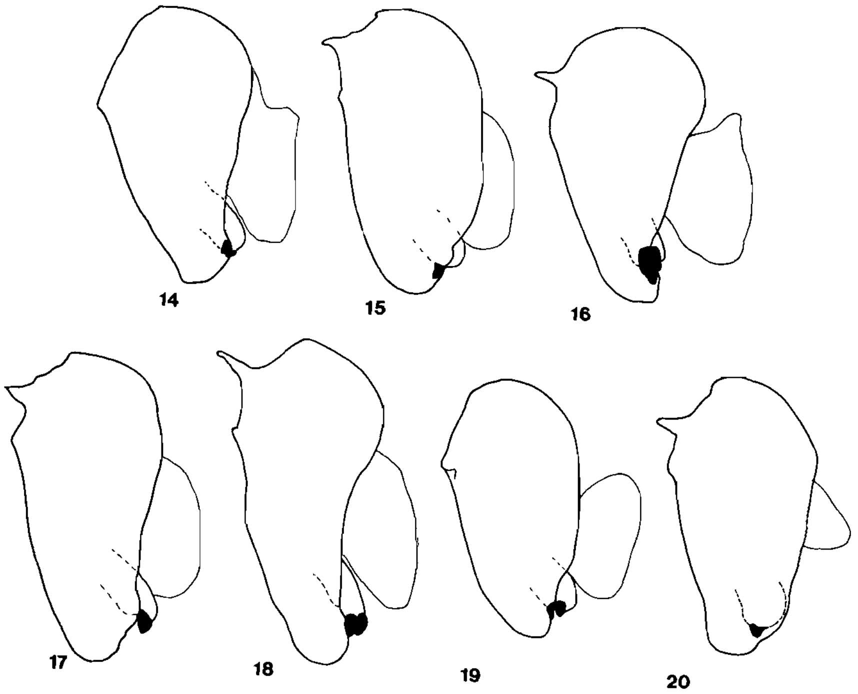
(Figs 6, 14, 21, 26, 37)

Craspedoxantha indica Zaka-ur-Rab, 1960:683 (Figs 1–4); Hardy, 1977:101 (catalogue); Kapoor & Malla, 1979:227, 228 (list); Kapoor, Hardy, Agarwal & Grewal, 1980:60 (list); Kapoor & Agarwal, 1983:256 (list).



Figs 6–13. *Craspedoxantha* spp., wing. 6. *C. indica* Zaka-ur-Rab. 7. *C. manengubae* Speiser. 8. *C. marginalis* (Wiedemann). 9. *C. milleri* sp. n. 10. *C. octopunctata* Bezzi. 11. *C. polyspila* Bezzi. 12. *C. vernoniae* sp. n. 13. *C. yaromi* sp. n.

Discussion: This species, adequately described and illustrated, was based on one male collected in Aligarh (Uttar Pradesh, India) (Zaka-ur-Rab 1960), and there is no need to redescribe it here. It is readily distinguished from *C. octopunctata* Bezzi, the only other Oriental congener, by lacking a yellow band along vein CuA_1 in the wing. It is actually more similar to *C. yaromi* sp. n., with which it shares an almost identical wing pattern (Fig. 6). However, these two species can be separated by the characters mentioned in the key, as well as by their terminalia. The aculeus of *C. indica* (Fig. 37) is relatively narrower and more pointed than that of *C. octopunctata*, and the epandrium (Figs 14, 21) has a different shape. However, the aedeagus of *C. indica* (Fig. 26) is very similar to that of *C. octopunctata* (not illustrated), indicating close affinity between these species. The male from Nagpur, which I examined, was erroneously recorded by Senior White (1922) as *C. octopunctata* Bezzi.



Figs 14–20. *Craspedoxantha* spp. epandrium, lateral view. 14. *C. indica* Zaka-ur-Rab. 15. *C. manengubae* Speiser. 16. *C. marginalis* (Wiedemann). 17. *C. octopunctata* Bezzi. 18. *C. polyspila* Bezzi. 19. *C. vernoniae* sp. n. 20. *C. yaromi* sp. n.

Material examined: INDIA: MADHYA PRADESH, Nagpur, i.1920, R. Senior White, bred in *Goniocaulon* flowers (1 ♀ BMNH); Neemach, 10.v.1975, S. K. Gupta (1 ♂ ZSIC); PAKISTAN: Tandojam, i.1960, in cucurbit field (1 ♂ 1 ♀ BPBM).

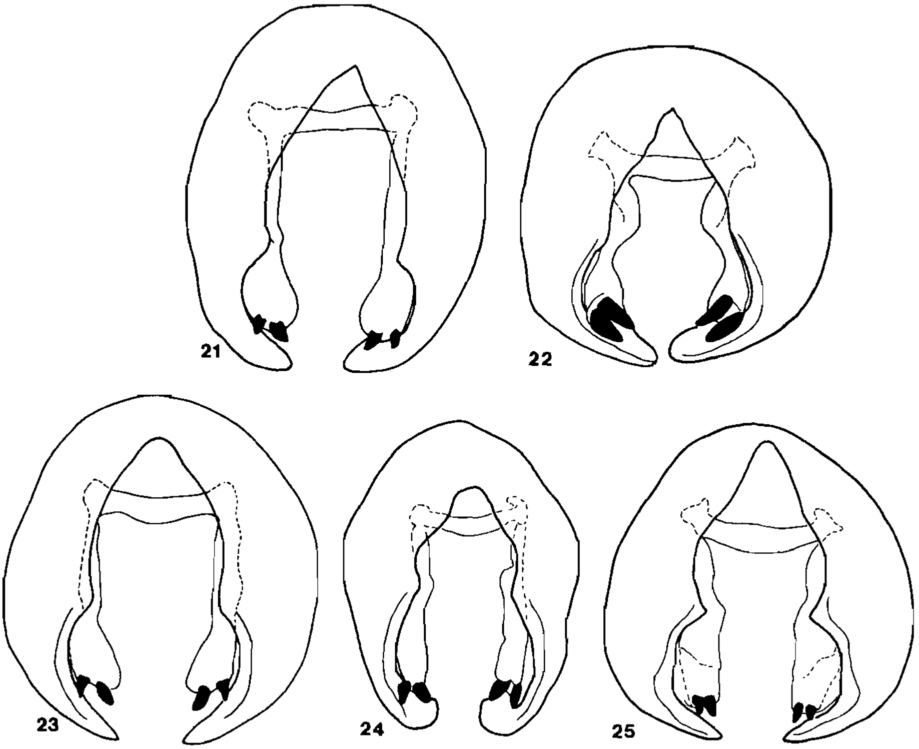
Host-plants: The only known host is *Goniocaulon glabrum* Cass. which was erroneously recorded by Senior White (1922) as host of *C. octopunctata*.

Craspedoxantha manengubae Speiser

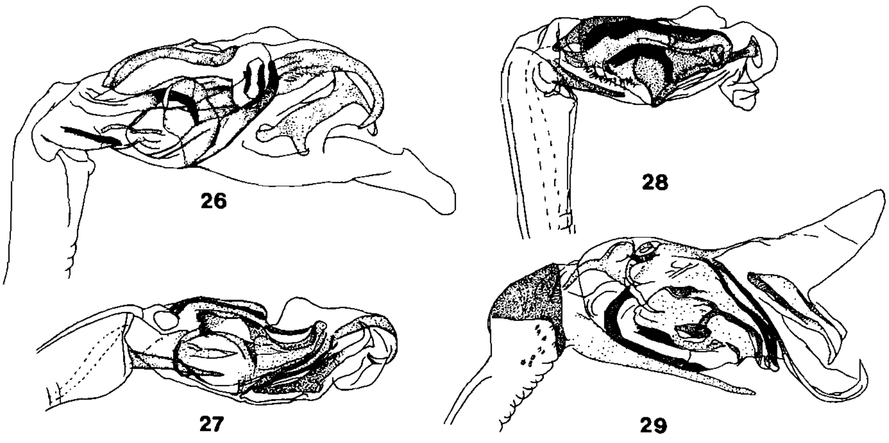
(Figs 7, 15, 31, 38)

Craspedoxantha manengubae Speiser, 1915:104; Bezzi, 1918:17 (misidentification of *C. vernoniae*); 1920:213 (list); 1924*a*:117 (key to Afrotropical species); Hering, 1954:10 (Tanzania record); Cogan & Munro, 1980:551 (catalogue).

Discussion: This species was described in great detail, based on a single male from Cameroon (Speiser 1915). However, based on this description, it can hardly be distinguished from *C. vernoniae* sp. n., its nearest congener. As a consequence, specimens of *C. vernoniae* were misidentified as *C. manengubae* (eg. Bezzi 1918), and these misidentifications led also to incorrect distribution records. While Cogan & Munro (1980) stated that it is widespread in East Africa, I could verify records from West Africa only. Apart from its distribution, the only indication to the identity of Speiser's species is the 'breitem, schwarzbraunem Spitzenfleck' which is



Figs 21–25. *Craspedoxantha* spp. epandrium, ventral view. 21. *C. indica* Zaka-ur-Rab. 22. *C. marginalis* (Wiedemann). 23. *C. octopunctata* Bezzi. 24. *C. polyspila* Bezzi. 25. *C. yaromi* sp. n.



Figs 26–29. *Craspedoxantha* spp., aedeagus. 26. *C. indica* Zaka-ur-Rab. 27. *C. marginalis* (Wiedemann). 28. *C. polyspila* Bezzi. 29. *C. vernoniae* sp. n.

narrow in *C. vernoniae*. This spot occupies in *C. manengubae* ¼–⅓ of the apical section of vein M (Fig. 7) and in *C. vernoniae* only ⅕–¼ of this section. The two species can be further distinguished based on the characters given in the key and by their terminalia (see Figs 15, 31, 38).

Material examined: CAMEROON: Mt. Cameroon, Mannsquell Hut, 18.v.1938, from *Vernonia* (1 ♂ 1 ♀ BMNH); 29.iv.-7.v.1938, H. Buhr (1 ♀ ZMHB); 6 km E. Bamenda, 30.i.1982, reared from seed head of *Vernonia* sp., G. J. Steck (12 ♂ 10 ♀ TAU).

Host-plants: *Vernonia* sp.

Craspedoxantha marginalis (Wiedemann)

(Figs 1, 2, 4, 8, 16, 22, 27, 32, 39)

Tephritis marginalis Wiedemann, 1818:47.

Terellia marginalis; Macquart, 1843:384 (list).

Trypeta marginalis; Wiedemann, 1830:482 (redescription). Loew, 1861:255 (list); 1862:60 (discussion); Becker, 1903:131 (list); Bezzi, 1908:140 (list).

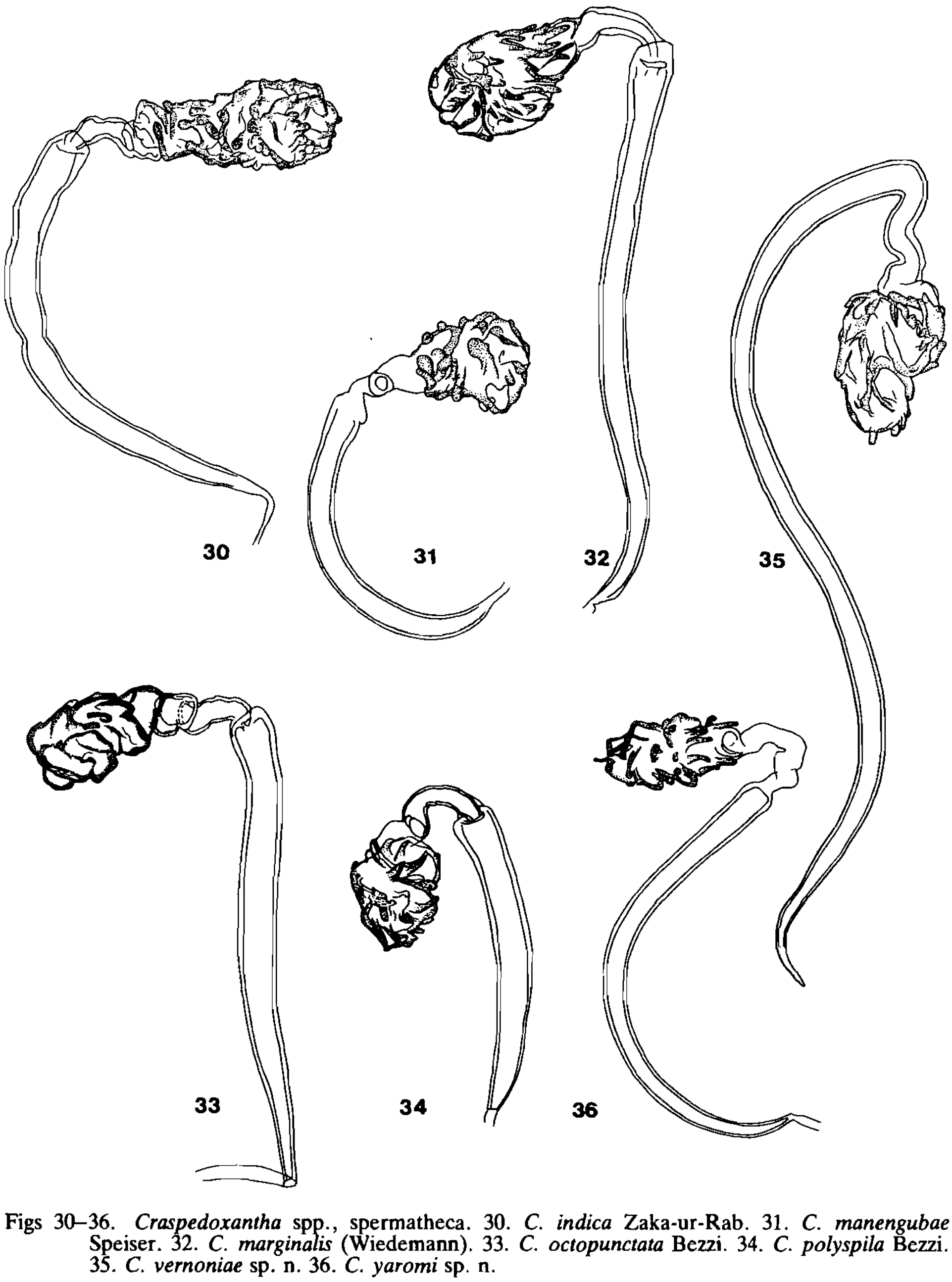
Craspedoxantha marginalis Bezzi, 1913:156 (assignment to *Craspedoxantha*); 1918:17 (key); 1920:213 (list); 1924*a*:117 (redescription); 1924*b*:505 (description and figure of wing); Munro, 1925:52 (biology); 1929:13 (biology); 1935:31 (biology); 1957:888 (Kenya record); 1964:13 (pest status); Hering, 1937:264 (Ethiopia record); Cogan & Munro, 1980:551 (catalogue).

Discussion: Wiedemann's (1818) short description of the female holotype was augmented by Bezzi's redescription (1924*a*) which was based on males. The species is distinguished from *C. polyspila* and *C. milleri* by lacking black spots around the insertions of the basal scutellar bristles, and from *C. unimaculata* and *C. milleri* by having the spots around the insertions of the apical scutellars separate. It differs from the other congeners (*manengubae* species group) by the characters used in the key to separate the two species groups.

The antenna, as in the other members of this species group, is relatively long (Fig. 1). The scutellum is densely covered by black setulae, which extend beyond its apex to its ventral aspect, and bears yellowish setulae only narrowly, between the basal scutellar bristles (Fig. 2). The legs, as in all species of this group, are turgid, and the femora are densely setulose ventrally (Fig. 4). The abdomen, posterior of tergite 1, is covered entirely, or almost entirely, by black setulae.

A variation was observed in the shape of the marginal band of the wing. While most studied specimens have this band evenly narrow (Fig. 8), in a few from South Africa it broadens conspicuously opposite r–m crossvein. No further differences were found between specimens of the two groups, and the significance of this single character remains unclear. The male's terminalia (Figs 16, 22, 27) and the female's terminalia (Figs 32, 39) may further serve to distinguish this species from *C. polyspila*, the only other member of this group that was dissected.

Material examined: Holotype ♀; Cap(e), Coll. Winthem; *marginalis* det Wiedem(ann) Type (printed on a small red label); *marginalis* Wd, Cap. For lack of evidence that there were other specimens seen by Wiedemann, when he described this species, I consider this female as the holotype and label it with a larger red label. The holotype is deposited in NHMV. Additional specimens: SOUTH AFRICA: *Transvaal:* Pretoria, xi.1928, H. K. Munro (1 ♂ 1 ♀ USNM); 16.xii.1914, H. K. Munro (1 ♂); 20.xii.1918, H. K. Munro (1 ♂ MSNM); ii.1931,



Figs 30–36. *Craspedoxantha* spp., spermatheca. 30. *C. indica* Zaka-ur-Rab. 31. *C. manengubae* Speiser. 32. *C. marginalis* (Wiedemann). 33. *C. octopunctata* Bezzi. 34. *C. polyspila* Bezzi. 35. *C. vernoniae* sp. n. 36. *C. yaromi* sp. n.

H. K. Munro (1 ♀ BMNH); 13.ii.1972, A. Freidberg (1 ♂ TAU); ii.1914, Miss J. Brickner (1 ♀ BMNH); 25.iii.1940, C. J. Swierstra (6 ♂ 5 ♀); 28.ii.1956, L. Vari (1 ♂); 18.ii.1932, J. Wagner (1 ♀); iii.1931, H. K. Munro (1 ♂); Ofcolaco, 20.ix.1960, Van Son & Vari, ex *Gerbera james(onii)* (1 ♂) (all in NMSA); Johannesburg, iii.1932, Dawson & Brunton (1 ♂ 1 ♀ MNHP); 5 mi. W. Warmbad, 24–25.ii.1968, Krombein & Spangler (1 ♂ USNM); Sabie, iv–vi.1951, H. K. Munro (1 ♂ NCIP). *Cape Province:* Grahamstown, x & xi, 1947, John Hewitt (2 ♂, 4 ♀ NCIP); Cape Peninsula, Cape Town to Cape Point, 1930, H. W. Simmond (1 ♂ BMNH). *Natal:* Nagle Dam, 1967, intercepted at Washington D.C. in *Vernonia shirensis* seed (2 ♂ 1 ♀ 6 puparia USNM); Durban, xii. 1932, W. E. Marriott (1 ♀); Gingindhlovo, Zululand, iv.1960, T. Schofield (1 ♂); Dukuduku between St. Lucia and Matubatuba, Zululand, B. & P. Stuckenberg, 7–8.iv.1960 (1 specimen); Pietermaritzburg, 17.iii.1955, H. K. Munro (1 ♀) (all NMSA), 1.x.1983 (2 ♂ 2 ♀), Uvongo, South Coast 12.x.1983 (1 ♂); Highflats, 10.x.1983 (1 ♀); Vernon Crooks Nature Reserve, 10.x.1983 (1 ♀) (all A. Freidberg TAU). SUDAN: Khartoum, 3.x.1961, Kaatz & Mondil, *Zinnia* blossom (3 ♂ 3 ♀), 1–10.ii.1936, bred from *Zinnia* flower, H. W. Bedford (2 ♂ 2 ♀) (all USNM). ETHIOPIA: Harrar, 1912, G. Kristensen (1 ♂ ZMHB). KENYA: Mt. Elgon, 10 500–11 500 ft, Heath Zone, ii.1935, F. W. Edwards (1 ♂ BMNH); Nairobi, 1 750 m, 28–31.vii.1975, B. Petersen (1 ♂ ZMUC); Nal, 22.vii.1977, Omenyo, Ex *M. patula* (1 ♂ BMNH); Chania Falls, nr. Thika, 4 400 ft, 4.xii.1969, M. E. Irwin & S. Ross (1 ♂ CAS), without locality, 3.v.1955, T. J. Crowe (2 ♂ BMNH). TANZANIA: Matengo-Hochland WSW v. Songa, Ugano, 1 500–1 700 m, 21–31.i.1936, Zerny (1 ♂ NHMV); Tanga, 15.xi.1966, D. O. Chanter (1 ♂ CNC). MALAŴI: Mlanje, 20.iii.1913, S. A. Neave (1 ♂ BMNH); Cholo, R. C. Wood (1 ♀ SMNC). ZIMBABWE: Mazoe, viii.1932, W. K. Ford (1 ♂ BMNH); Chipinga, 29–31.v.1980, D. L. Hancock, on *Vernonia glabra* (1 ♂ 1 ♀ NMB). ANGOLA: Vila Luso, Mox., 25.ix.1949, B. Malkin (1 ♂ CAS). GAMBIA: Bakau, 13.xii.1982, L-Å. Janzon, ex flower head of *Vernonia perrottetii* Sch Bip. (2 ♂ 1 ♀ NRS).

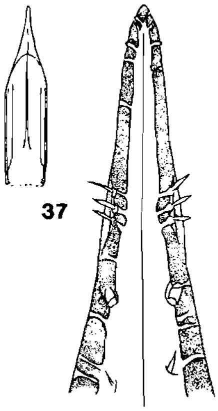
Host-plants: The following are compiled from Munro (1925 1929 1935 1964): *Arctotis* sp., *Berkheya latifolia* Wood et Evans, *Callilepis laureola* DC., *C. leptophylla* Harv., *Dahlia* sp., *Dicoma anomala* Sond., *Gazania* sp., *Gerbera aurantica* Sch. Bip., *G. jamesonii* Hook, *G. piloselloides* (L) Cass., *G. plantaginea* Harv., *Vernonia melleri* Oliver et Hiern, *V.* sp., *Zinnia* sp. The following species are recorded here for the first time: *Vernonia perrottetii* Sch. Bip. and *V. adoensis* Sch. Bip. (as *shirensis*).

Craspedoxantha milleri sp. n.

(Fig. 9)

Diagnosis: This species belongs to the *marginalis* species group and agrees with all the characteristics of this group. It differs from all congeners by having a transverse, zigzag, blackish band across the wing over both r-m and dm-cu crossveins.

Description: As in the generic description, but with the following details. Length (♀): body and wing—5 mm.



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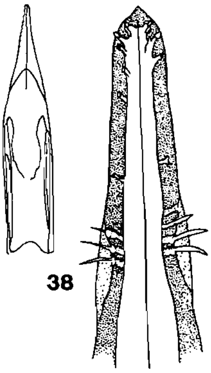

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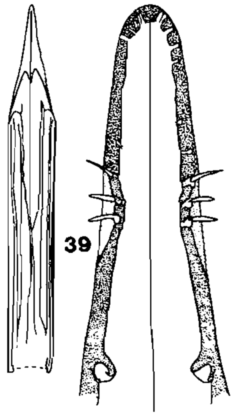

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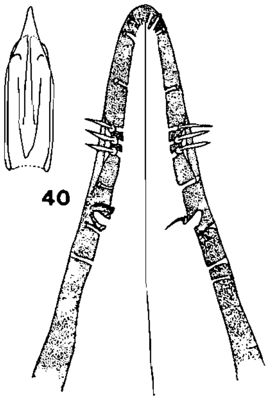

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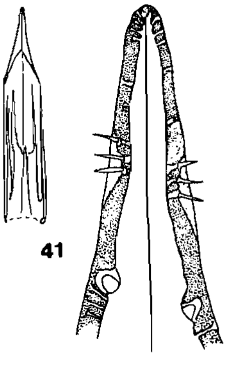

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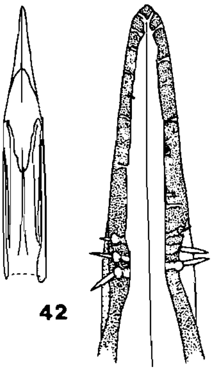

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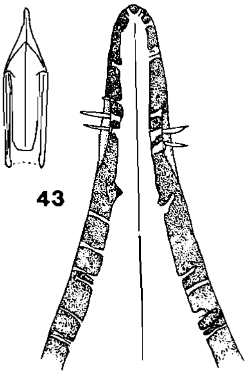

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Figs 37–43. *Craspedoxantha* spp., aculeus (left side—whole, right side—apex). 37. *C. indica* Zaka-ur-Rab. 38. *C. manengubae* Speiser. 39. *C. marginalis* (Wiedemann). 40. *C. octopunctata* Bezzi. 41. *C. polyspila* Bezzi. 42. *C. vernoniae* sp. n. 43. *C. yaromi* sp. n.

Head: As in *C. marginalis* (compare with Fig. 1), whitish to yellow, with 4 blackish, radiating vittae on dorsal postcranium, and with blackish setulae over parafrontalia, gena, scape and pedicel; bristles brown; postocular row and all postcranial setulae pale yellow; antenna yellow, arista with yellow base and blackish thin part. Proboscis and palpus whitish to yellowish; latter with apical setulae darker than rest.

Thorax: Lyre-like pattern black, especially behind suture; usual 10 black round spots on scutum large; adpressed setulae whitish; dorsocentral bristles aligned with anterior supra-alar bristles; 2 anepisternal bristles present; pleura striated, with a yellow band from anterior spiracle obliquely across anepisternum, ventral part of anepimeron and laterotergite; scutellum with a small black spot around base of each of basal bristles, and with apical spots large, united, leaving only apex of scutellum narrowly yellow; scutellum with whitish setulae between bases of basal bristles, and with black setulae more apically; subscutellum and mediotergite black; former medially microtomentose; latter laterally microtomentose, centrally shiny. Calypteres yellow, with brownish margin; halter yellow.

Legs: Yellow; femora with irregular brown spots on apical $\frac{1}{4}$–$\frac{1}{3}$. Bristles on fore femora mostly yellow; other bristles and setulae mostly blackish; femora ventrally densely covered with setulae.

Wing (Fig. 9): With usual marginal band terminating in a broad, uninterrupted, blackish spot; a blackish transverse band, narrow over r-m crossvein, thence over vein M between r-m and dm-cu crossveins, thence widening over dm-cu crossvein, occupies apical third of discal cell and base of cell m; the transverse band reaches posterior wing margin over apex of vein CuA_1; cell *cup* distinctly and entirely yellow; this yellow area extends to base of cell cua_1 and over bm-cu crossvein, almost uniting with marginal band; vein R_{4+5} dorsally with 5–6 setulae at node and 0–1 over first section of vein, ventrally with 3 setulae at node.

Abdomen: With usual pattern and vestiture; anterior margin of T3 and T4 medially with a pair of small black dots; of T2–5 only T5 has some scattered yellowish setulae. Terminalia not dissected.

Material examined: SOUTH AFRICA: *Natal:* Holotype ♂, Giants Castle Game Reserve, 23.ii.1982, R. M. Miller (NMSA)/ ♂ Holotype, *Craspedoxantha milleri* Freidberg. The holotype is in good condition and has the right wing removed and mounted on a separate slide. NMSA Type No. 3179

Host-plants: Unknown.

Etymology: A genitive patronym to honour Dr Raymond M. Miller, who collected this interesting species.

Craspedoxantha octopunctata Bezzi

(Figs 10, 17, 23, 33, 40)

Craspedoxantha octopunctata Bezzi, 1913:156 (Pl. X, fig 59); Senior White, 1922:98 (misidentification of *C. indica*); Bhatia, 1939:108 (India record); Zaka-ur-Rab, 1960:683 (comparison with *C. indica*); Menon, Kapoor & Mahto, 1968:316 (host-plant); Hardy, 1973:318 (redescription), 1977:101 (catalogue); Kapoor, Agarwal & Grewal, 1977:621 (distribution); Kapoor & Malla, 1979: 238 (list); Kapoor, Hardy, Agarwal & Grewal, 1980:60 (distribution and hosts); Kapoor & Agarwal, 1983:256 (host-plants).

Discussion: This species was adequately described and illustrated by Bezzi (1913) and Hardy (1973), and only a few remarks should be added here. It is readily distinguishable from all other congeners by the presence of an additional yellow band on the wing, from cell *cup* along vein CuA_1 to posterior wing margin (Fig. 10). The male's terminalia (Figs 17, 23) and the female's terminalia (Figs 33, 40) resemble closely those of *C. indica*, differences being discussed under the latter species. In the generic description, which was based on the holotype of this species, Bezzi stated: 'or 1.3', meaning 1 upper and 3 lower orbitals, but my examination of the holotype shows that it has the normal two upper orbital bristles, one of them broken. The species has been reported from India, but I have seen specimens only from Burma and Vietnam. At least one Indian record (Senior White 1922) was found to be a misidentification, and it is possible that this and other mistakes were perpetuated through the literature.

Material examined: BURMA: Holotype ♀, Dawna Hills, 2 000–3 000 ft, 2–3.iii.1908, N. A[nnandale]/ TYPE/ *Craspedoxantha* n.g. *octopunctata* n. sp. (ZSIC). Additional specimens: VIETNAM: Mt. Lang Bian 1 500–2 000 m, 19.v.–8.vi.1961, N. R. Spencer (2 ♀ BPBM); Dalat, 1 500 m, 29.iv–4.v.1960, L. W. & S. Quate (1 specimen abdomen missing BPBM); Dalat, 6 km S., 1 400–1 500 m, 9.vi.–7.vii.1961; N. R. Spencer (1 ♂ BPBM).

Host-plants: Kapoor *et al* (1980) recorded flower heads of *Goniocaulon glabrum*, *Anthea rosea*, *Helianthus* sp. and *Centaurea* spp. as hosts of this species. However, the first mentioned host actually refers to *C. indica*, and the identity of the second host could not be verified.

Craspedoxantha polyspila Bezzi

(Figs 11, 18, 24, 28, 34, 41)

Craspedoxantha polyspila Bezzi, 1924*b*:505 (Pl. XIII, fig. 51); 1924*a*:117 (key); Cogan & Munro, 1980:551 (catalogue).

Discussion: This species was adequately described and illustrated (Bezzi 1924*b*), based on a single female from Salisbury, Southern Rhodesia (= Harare, Zimbabwe). The holotype (checked) is badly damaged and there are only the thorax, wings and 3 legs left. However, since several of the specific characters concern these parts, it was possible to ascertain the concept of this species. It is light yellow, with the scutal lyre-like pattern light yellow, sometimes indistinct. It shares with *C. milleri* the presence of small black spots around the insertations of the basal scutellar bristles. However, it differs from this species in having the apical scutellar spots separate, in lacking a transverse band on the wing (Fig. 11) and in its paler coloration. The male's terminalia (Figs 18, 24, 28) and the female's terminalia (Figs 34, 41) may help to distinguish it from *C. marginalis*, which is another closely related congener.

Material examined: Holotype ♀, Salisbury, S. Rhodesia [Zimbabwe], R. W. Tucker; *Craspedoxantha polyspila* n. sp. Type ♀ (SAMC). According to Bezzi (1924*b*)it was collected in May 1917. The head, abdomen and 3 legs are missing. Additional specimens: GAMBIA: Bakau, at Tropic Bungalow, 16–18.xi.1977, Cederholm, Danielsson, Hammarstedt, Hedvist & Samuelsson (1 ♂ UZIL).

Bakau, 8.xi.1981 (4 ♂ 1 ♀), 15.xi.1981 ex flower head of *Centaurea perrottetii* DC. (1 ♂ and associated puparium); 12.xii.1982, ex flower head of *C. perrottetii* (2 ♂) (all collected by L-Å. Janzon; NRS). ZAÏRE: Sakania, ix.1931, Miss A. Mackie (1 ♂ BMNH). MALAŴI: Maiwale, 5–22.v.1932, reared from flower head of a Compositae, W. A. Lamborn (6 ♂ 2 ♀ BMNH); Limbe, 4 000 ft, 22.ix.1916, R. C. Wood (1 ♂ headless BMNH); Mlanje, 1913, S. A. Neave (1 ♂ BMNH). KENYA: Bungoma, 6.xi.1983, A. Freidberg (1 ♂ TAU).

Host-plants: The only identified host is *Centaurea perrottetii.*

Craspedoxantha unimaculata Bezzi

Craspedoxantha marginalis unimaculata Bezzi, 1924*b*:505.
Craspedoxantha unimaculata. Bezzi, 1924*a*:117 (key); Cogan & Munro, 1980:551 (catalogue).

Discussion: The original description was based on a single male from Mt. Tulbagh, Cape Province, South Africa, and the species has not been collected again. Bezzi (1924*b*), describing it as a variety of *C. marginalis*, stated that it differs from *C. marginalis* in its darker coloration and in having the apical spots of the scutellum fused to form a single broad black spot. The first character does not seem to be a reliable one, because it is variable in *C. marginalis*. However, based on the second character, the specimen does differ from all specimens of *C. marginalis* that I have studied, and therefore it is retained here as a separate species. Additional specimens and dissections of terminalia of both sexes are needed in order to clarify the status of this species. The only other studied specimen of *Craspedoxantha* that has the apical spots of the scutellum fused, is the one described here as *C. milleri*, but this specimen has a brown transverse band on the wing, which is missing in *C. unimaculata*.

Material examined: Holotype ♂, Gt. Winterhoek, Tulbagh, 3 800 ft [SOUTH AFRICA; *Cape Province*]/ *Craspedoxantha marginalis unimaculata* n.var. Type ♂. According to Bezzi (1924*b*) it was collected in April 1916 by R. M. Lightfoot. The specimen lacks the right wing and the apical part of the left wing (SAMC).

Host-plants: Unknown.

Craspedoxantha vernoniae sp. n.

(Figs 3, 5, 12, 19, 29, 35, 42, 44)

Diagnosis: Similar to *C. manengubae* Speiser, *C. yaromi* sp. n. and *C. indica* Zaka-ur-Rab, in having no black spots on the scutellum and no complete yellow band in addition to the marginal band of the wing. It differs from *C. manengubae* in the shape of the marginal band, which is wider at level of r-m crossvein, touching or almost touching vein R_{4+5}, and ending in a narrower blackish spot at apex of wing. Both species also differ in details of their terminalia. *C. vernoniae* differs from *C. indica* in having the yellow pattern on cell cua_1 very light, hardly visible, in the smaller presutural black spots on the thorax and in its terminalia. Differences from *C. yaromi* are noted under that species.

Description: Length of wing: 5,5–8 mm.

Head: Similar in shape to *C. marginalis*, but with shorter 1st flagellomere, only 1,5–2 times as long as wide and 1,5 times as long as pedicel (in *C. marginalis* 2,5 times). Dull yellow, except face whitish and epistome shiny.

Thorax (Fig. 3): Normal for genus; scutal length to width ratio = 1,15:1; dorsocentral bristles aligned about midway between anterior supra-alars and suture; 1 anepisternal bristle present; dorsocentral and prescutellar black spots large; supra-alar spot almost as large or considerably reduced in size; presutural spot much smaller than dorsocentral spot; scale-like setulae on scutum very dense, yellow, hardly extending beyond black, lyre-like pattern. Scutellum unspotted, predominantly covered by blackish setulae, with yellowish setulae only near insertions of basal scutellars; pleura not striated; subscutellum and mediotergite black, densely covered by greyish-yellow microtomentum, except corners of subscutellum and ventral margin of mediotergite, which in posterior view appear less densely covered by microtomentum. Calypteres yellow, with brownish margins; halter yellow.

Legs (Fig. 5): Yellow, elongate; femora without distinctly dense setulae ventrally.

Wing (Fig. 12): Marginal band touching or almost touching vein R_{4+5} at point where r-m crossvein meets with vein R_{4+5}; apical blackish spot evenly narrow, as wide as $\frac{1}{5}$–$\frac{1}{4}$ of terminal section of vein M; cell *cup* very lightly yellow; vein R_{4+5} with 1–4 setulae dorsally and ventrally at node.

Abdomen: Normal for genus; T2 to last with predominantly blackish setulae, more or less extensively covered by yellowish setulae anteriorly; ♂ with or without small black spots on anterior margin of T3 and T4; ♀ usually with such spots on T4–T6; oviscape about as long as combined length of posteriormost 4 tergites; ♂ terminalia as in Figs 19, 29; ♀ terminalia as in Figs 35, 42. The long basal spine of aedeagus is also characteristic of *C. marginalis* and *C. yaromi*.

Material examined: Holotype ♀, KENYA: Eldoret, 30.x.1983, A. Freidberg/ ♀ holotype, *Craspedoxantha vernoniae* Freidberg. Allotype ♂, 23 ♂ 12 ♀ paratypes, same data as holotype, A. Freidberg & I. Yarom, all swept from *Vernonia adoensis* Sch. Bip. Additional paratypes: KENYA: 10 km E. Kitale, 2.xi.1983, sweeping *Vernonia calvoana* (Hook.f.) Hook. f. (5 ♂ 10 ♀); same collecting data, ex *V. calvoana*, xi.1983 (1 ♀); 15 km N. Kitale, 5.xi.1983, (1 ♂ 1 ♀); Kapcherop (Cherangani Hills), 2.xi.1983, (1 ♂); Malikisi (near Bungoma), 7.xi.1983, (2 ♂); Chepsonoi (near Kakamega), 8–9.xi.1983, sweeping *V. calvoana*, (8 ♂ 10 ♀); same collecting data, ex *V. calvoana*, 18.xi.1983, (1 ♀) (all by A. Freidberg & I. Yarom; TAU). ETHIOPIA: Debra Libanos, 2.i.1972, A. Freidberg (1 ♀ TAU). UGANDA: Kawanda, 1.x.1961, JB (1 ♂ TAU). TANZANIA: Ngorongoro, 8–9.i.1972, A. Freidberg (1 ♂ 1 ♀ TAU); Makoa, 22–23.ii.1952, D.O. Afrika Exp. (1 ♂; SMNS). MALAŴI: Maiwale, 14.iv. & v.1932, Dr W. A. Lamborn (3 ♂ 4 ♀ BMNH); Mt. Mlange, 17.vi, 16.v. & 24.v.1913, ex Composite, S. A. Neave (2 ♂ 2 ♀ BMNH); Limbe, Chiromo Ruo. R., 22.ix.1916, R. C. Wood (1 ♂ 1 ♀ BMNH); Viphya Mtns., Chikangawa 1133Dd, 1 700 m, 5–8.xii.1980, forest edge and grassland, Stuckenberg & Londt (1 ♀ NMSA). ZIMBABWE: Vumba, 5.vi.1980, D. L. Hancock (1 ♀ NMB); Chirinda Forest, 1.vi.1980, D. L.

Hancock, on *Vernonia hymenolepis meridionalis* (1 ♀ NMB). The holotype and most paratypes are deposited in Tel Aviv University (TAU). Other paratypes were housed in their respective museums, while a few were deposited in USNM and NCIP.

Host-plants and biology: All the specimens from Kenya were collected by sweeping *Vernonia adoensis* and *V. calvoana*. Two specimens were also reared from flower heads of *V. calvoana*, which is also the host of *C. yaromi*. Eggs with very long petiole (Fig. 44) were dissected from a female's abdomen.

Etymology: This species is named after its host, *Vernonia*.

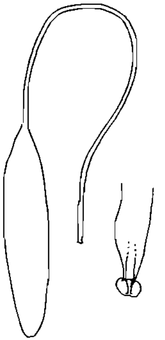

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Fig. 44 *Craspedoxantha vernoniae* sp. n. egg and enlarged micropilar end. (Length of egg without petiole 1 mm).

Craspedoxantha yaromi sp. n.

(Figs 13, 20, 25, 36, 43)

Description: Similar to *C. vernoniae*, differing in following character states: Length of wing 4,5–5 mm; scale-like setulae on scutum usually whitish or slightly yellowish; scutellum predominantly with rather sparse whitish setulae, with some blackish setulae only at posterior margin; presutural and supra-alar black spots less varied in size and not as small; calypteres whitish, with yellow margin; discal cell especially in distal half and immediately external to it with light-yellow pattern, similar in intensity to yellow on cell *cup*, and more distinct along sections of veins bordering this area (Fig. 13); abdomen predominantly with whitish setulae, with blackish setulae laterally and along posterior margins of tergites, one row on each tergite, except last which may bear more rows medially; ♂ and ♀ usually without small black spots on tergites, but T5 of ♂ normally spotted. ♂ terminalia (Figs 20, 25) resemble closely those of *C. vernoniae*, but ♀ aculeus (Fig. 43) and spermathecae (Fig. 36) differ considerably, especially aculeus which is relatively much shorter (length to width ratio 3,7:1 in *C. yaromi*; 6,1:1 in *C. vernoniae*).

Material examined: KENYA: Holotype ♀, Chepsonoi (E. of Kakamega), 8–9.xi.1983, I. Yarom/ sweeping *Vernonia calvoana*/ ♀ holotype, *Craspedoxantha yaromi* Freidberg. Allotype ♂, 9 ♂ 11 ♀ paratypes, same collecting data, I. Yarom

& A. Freidberg. Additional paratypes: same collecting data, ex *V. calvoana*, 18.xi.1983 (1 ♀). TANZANIA: East Usambara, Ameni, 1 000 m, 23.i.1977, H. Enghoff, O. Lomholdt, O. Martin (1 ♀ ZMUC). The holotype and most paratypes are deposited in Tel Aviv University (TAU). Some paratypes have been deposited in USNM, BMNH, NCIP and ZMUC.

Host-plants: Almost all the specimens were collected by sweeping *Vernonia calvoana*. A single female was reared from a flower head of this plant. Specimens of *C. vernoniae* were also collected and reared from the same species.

Etymology: A genitive patronym to honour Mr I. Yarom, who collected a series of this species.

PHYLOGENY

As mentioned before, *Craspedoxantha* is relatively isolated within the Terelliinae and it is difficult to relate it to any other genus in the subfamily except, perhaps, to *Orellia* Robineau-Desvoidy. *Orellia* is the largest assemblage of Old World species of Terelliinae, mostly infesting flower heads of Cynareae. It is heterogenous, possibly even paraphyletic, and its *falcata* group of species (*distans* (Loew), *falcata* (Scopoli) and *punctata* (Schrank)), which do not infest Cynareae, might be closely related to *Craspedoxantha*. However, it should be remembered that species of the *falcata* group and in fact all the Terelliinae, with the exception of *Craspedoxantha*, are restricted to the northern temperate regions. Furthermore, the single *Orellia* species that has invaded the Oriental Region is not related morphologically or biologically to *Craspedoxantha*. Hence, in this case, zoogeography is of little assistance in establishing phylogenetic relationships.

The nine species treated in this revision are closely related and clearly form a monophyletic group. The genus can be divided into two species-groups that may deserve subgeneric rank. These two groups, the *marginalis* and *manengubae* species-groups, represent the first splitting of the phylogenetic tree suggested here (Fig. 45). The *marginalis* group is characterised by spotted scutellum, more posterior insertation of the dorsocentral bristles, two anepisternal bristles and relatively short, turgid legs, with femora setulose ventrally. In addition, the antennae (especially the first flagellomere) in species of this group are generally longer than in the *manengubae* group, the length to width ratio of the mesonotum is generally smaller, and the pale, scale-like setulae on the scutum are more elongate, sparser and tend to extend more laterally (Figs 2–3). Characters of the terminalia were not found to corroborate with, nor to contradict, these external characters. All members of the *marginalis* group are Afrotropical. The *manengubae* group contains three closely related, Afrotropical species, as well as two Oriental species. These Oriental species are somewhat atypical in having the notal setulae as in the *marginalis* group, and also by having the prescutellar black spots larger than the dorsocentral spots, a situation opposed to that found in the Afrotropical members of the *manengubae* group and characteristic of the *marginalis* group. However, the Oriental species conform well with all other essential characters of the *manengubae* group.

The phylogeny of the *marginalis* group probably corresponds to the dichotomy presented in the key. The phylogeny of the Afrotropical members of the

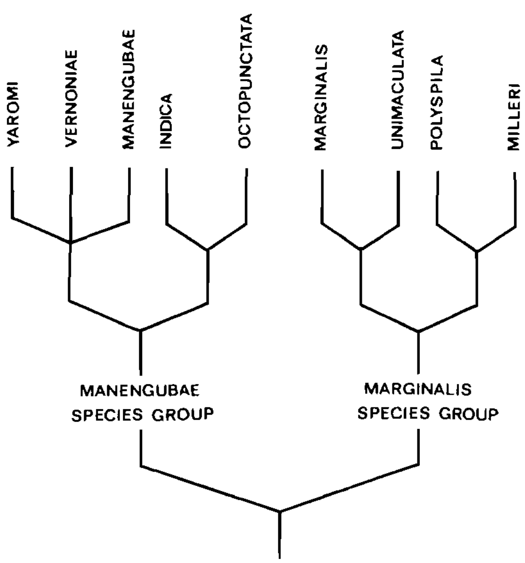

Fig. 45 Hypothetical phylogeny of the species of *Craspedoxantha*.

manengubae group may also behave in the same way. However, more data on host plants, biology and distribution are needed in order to present a more conclusive phylogenetic picture for *Craspedoxantha*.

ZOOGEOGRAPHY

Three apparent peculiarities characterise the distribution and zoogeography of *Craspedoxantha* (Fig. 46): It is one of the few real Palaeotropic genera of Tephritidae; it is the only tropical member of its subfamily, and it exhibits an apparently disjunct distribution.

A study of the recent Afrotropical and Oriental catalogues of Tephritidae shows that out of 150 recorded Afrotropical genera (Cogan & Munro 1980) and 173 recorded Oriental genera (Hardy 1977), less than 10 are restricted to these two regions, and *Craspedoxantha* is one of these. Most genera common to both regions (eg. *Ceratitis*, *Dacus*, *Paroxyna*, *Trupanea*) have a much wider distribution, sometimes being almost cosmopolitan.

The presence of *Craspedoxantha* in the tropics is puzzling, since it is the only tropical member of its subfamily. All other genera and species of Terelliinae are strictly or almost strictly Palaearctic, Nearctic or Holarctic. This raises the question of whether the subfamily originated in the tropics, with *Craspedoxantha* closer to the ancestor of the subfamily, and with the proliferation of species taking place later in the Holarctic. On the other hand the subfamily may have originated and proliferated in the Holarctic, and giving an offshoot towards the tropics. This question must remain unanswered until the phylogeny of the subfamily is better understood.

The apparent disjunct distribution of *Craspedoxantha* is probably attributable mainly to technical factors (such as lack of sufficient collecting) and not to real

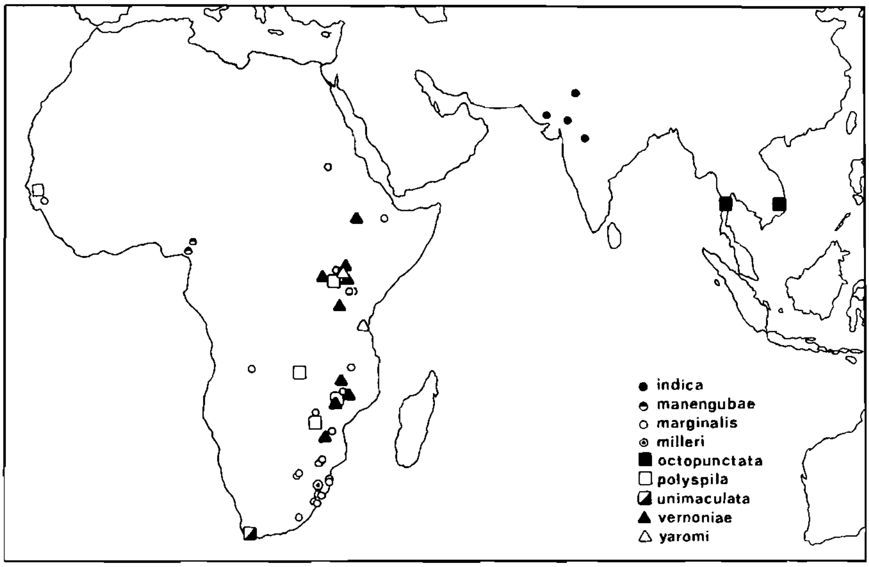

Fig. 46 Distribution of the known species of *Craspedoxantha* based on records established during this study.

historical events and ecological situations. Only if the genus is indeed lacking from the southern and eastern regions of the Arabian Peninsula (which will be difficult to ascertain), would one be justified in claiming that the Oriental populations of *Craspedoxantha* became separate from the Afrotropical ones by the desertification of Arabia. Such a claim would also be supported by the African records of *Craspedoxantha*, all of which are essentially sub-Saharan.

BIOLOGY, IMMATURE STAGES AND ECONOMIC IMPORTANCE

Little is known about the natural history and immature stages of the species studied here. Most available information refers to *Craspedoxantha marginalis* (Munro 1925 1929 1935 1964 and Janzon, in press), *C. polyspila* (Janzon, in press) and several scattered host-plant records of other species. Munro found from one to five larvae of *C. marginalis* in a single flower-head of *Gerbera jamesonii*, destroying most of the seeds, but not greatly affecting the appearance of the flower. The larvae sometimes bored a short distance into the flower stem. On the other hand, in *Gerbera piloselloides* the larvae preferred boring into the flower stem rather than the flower head. In *Zinnia* one or two larvae were found in the flower heads, often damaging them considerably. In *Dicoma anomala* puparia were found in unopened buds. Parasitisation by parasitic Hymenoptera was sometimes over 90%. *C. marginalis* is rather polyphagous, having 15 known host plants. It is noteworthy that only 4 of these hosts belong to the genus *Vernonia*, whereas all known hosts of the Afrotropical members of the *manengubae* species-group are species of *Vernonia*. The two Oriental species of this group were recorded from several other host-plants, but some of them need confirmation. Records of special interest are the rearing of *C. octopunctata* (possibly a misidentification of *C. indica*) from

Centaurea americana (Menon *et al.* 1968), and *C. polyspila* from *Centaurea perrottetii* (Janzon, in press). These hosts belong to the tribe Cynareae, thus linking *Craspedoxantha* biologically with the main Holarctic stock of the Terelliinae.

Known larvae and pupae of *Craspedoxantha* (Janzon, in press) resemble those of other Terelliinae. Even long petiolated eggs, such as the one reported here in *C. vernoniae*, are found in other, closely related genera, such as *Chaetorellia* (Zwölfer & Freidberg, unpublished information).

Craspedoxantha marginalis was reported by Munro (loc. cit.) as a pest of various garden flowers in South Africa. This species is also reported here to have been intercepted at Washington D. C. in seeds of *Vernonia adoensis (= V. shirensis)* imported from Natal. In view of the relative polyphagous habits of this species and possibly of other congeners, care should be taken when importing flowers or seeds that are known, or suspected, hosts of these flies.

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REFERENCES

Becker, T. 1903. Aegyptische Dipteren. *Mitt. Zool. Mus. Berl.* **2**: 67–195.

Bezzi, M. 1908. Ditteri eritrei raccolti del Dott. Andreini e del Prof. Tellini. Parte Seconda. Diptera cyclorrhapha. *Boll. Soc. Ent. Ital.* **39** (1907): 3–199.

——— 1913. Indian Trypaneids (fruit flies) in the collection of the Indian Museum, Calcutta. *Mem. Indian Mus.* **3**: 53–175, pls. VIII–X.

——— 1918. Notes on the Ethiopian fruit flies of the family Trypaneidae, other than *Dacus* (s.l.) (Dipt.)—II. *Bull. Ent. Res.* **9**: 13–46.

——— 1920. Notes on the Ethiopian fruit flies of the family Trypaneidae, other than *Dacus*—III. *Bull. Ent. Res.* **10**: 211–272.

——— 1924*a*. Further notes on the Ethiopian fruit-flies, with keys to all the known genera and species. *Bull. Ent. Res.* **15**: 73–118.

——— 1924*b*. South African trypaneid Diptera in the collection of the South African Museum. *Ann. S. Afr. Mus.* **19**: 449–577.

Bhatia, H. L. 1939. New records of two fruit flies, *Dacus ciliatus* and *Craspedoxantha octopunctata* from Delhi. *Indian J. Ent.* **1**: 108.

Cogan, B. H. & Munro, H. K. 1980. Family Tephritidae. *In:* R. W. Crosskey, ed., Catalogue of the Diptera of the Afrotropical Region. British Museum (Natural History), London.

Foote, R. H. 1980. Fruit fly genera south of the United States (Diptera; Tephritidae). *U.S. Dept. Agr. Tech. Bull.* No. 1600, 79 pp.

Foote, R. H. & Freidberg, A. 1980. The taxonomy and nomenclature of some Palaearctic Tephritidae (Diptera). *J. Wash. Acad. Sci.* **70**(1): 29–34.

Freidberg, A. (1984). Gall Tephritidae, *In:* T. N. Ananthakrishnan, ed., *Biology of Gall Insects.* Oxford & IBH, New Delhi, India.

HARDY, D. E. 1973. The fruit flies (Tephritidae—Diptera) of Thailand and bordering countries. *Pacific Insects.* Monograph 31. Bernice P. Bishop Museum. Honolulu, Hawaii, USA. 353 pp + 8 pls.

——— 1977. Family Tephritidae. *In:* M. D. Delfinado and D. E. Hardy, eds. *A catalog of the Diptera of the Oriental Region.* The University Press of Hawaii, Honolulu.

HENDEL, F. 1914. Die Gattungen der Bohrfliegen. *Wien. Ent. Ztg.* **33**: 73–98.

——— 1927. Trypetidae. *In:* Lindner, E. ed., Die Fliegen der Palaearktischen Region. E. Schweizerbartsche Verlagsbuchhandlung. Stuttgart, West Germany.

HERING, E. M. 1937. Bohrfliegen aus der Beckerschen Sammlung (Dipt.). *Mitt. Zool. Mus. Berl.* **22**: 244–264.

——— 1947. Neue Gattungen und Arten der Fruchtfliegen. *Siruna Seva* **6**: 1–16.

——— 1954. Trypetidae (Dipt.) aus Ostafrika. *Bonn. Zool. Beitr.* **5**: 167–172.

JANZON, L-Å. (in press). Descriptions of last larval stages of *Craspedoxantha polyspila* Bezzi and *C. marginalis* (Wiedemann) (Diptera: Tephritidae) from the Gambia. *Ent. Scand.*

KAPOOR, V. C. & AGARWAL, M. L. 1983. Fruit flies and their increasing host plants in India. *In:* R. Cavalloro, ed. Fruit flies of economic importance. Proceedings of the CEC/IOBC International Symposium, Athens, Greece. A. A. Balkema, Rotterdam.

KAPOOR, V. C., AGARWAL, M. L. & GREWAL, J. S. 1977. Zoogeography of Indian Tephritidae (Diptera). *Oriental Insects* **11** (4): 605–621.

KAPOOR, V. C., HARDY, D. E., AGARWAL, M. L. & GREWAL, J. S. 1980. *Fruit fly (Diptera: Tephritidae) systematics of the Indian subcontinent.* Expert India Publications. Jullundur, India.

KAPOOR, V. C. & MALLA, Y. K. 1979. Tephritids (Diptera: Tephritidae) of Nepal and India (A taxonomic review). *J. Inst.Sci.* **2**(1): 223–249.

LOEW, H. 1861. Ueber die afrikanischen Trypetina. *Berl. Ent. Z.* **5**: 253–306.

——— 1862. Nachtrag zu den im vorigen Bande enthaltenen Beschreibungen afrikanischer Trypetinen. *Berl. Ent. Z.* **6**: 90.

MACQUART, J. 1843. Dipteres exotiques nouveaux ou peu connus [2(3)]. *Mem. Soc. Sci. Agric. Lille* **1842**: 162–460.

MCALPINE, J. F. 1981. Morphology and Terminology—Adults. *In* J. F. McAlpine *et al.*, (eds) *Manual of Nearctic Diptera*, Vol. 1. *Agriculture Canada, Research Branch, Monograph,* 27: 9–63, 146 figures. Ottawa.

MENON, M. G. R., KAPOOR, V. C. & MAHTO, Y. 1968. *Centaurea americana* as a new host plant record for the fruit flies, *A. helianthi* and *C. octopunctata* in India. *Indian J. Ent.* **30**: 316.

MUNRO, H. K. 1925. Biological notes on South African Trypaneidae (fruit flies)—I. *Entomology Mem. Dep. Agric. Un. S. Afr.* **3**: 39–67.

——— 1929. Biological notes on the South African Trypetidae (fruit flies. Diptera). III. *Entomology Mem. Dep. Agric. Un. S. Afr.* **6**: 9–17.

——— 1935. Biological and systematic notes and records of South African Trypetidae (fruit flies, Diptera) with descriptions of new species. *Entomology Mem. Dep. Agric. Un. S. Afr.* **9**: 18–59.

——— 1957. Trypetidae. *Ruwenzori Exped.* 1934–35, **2**: 853–1054.

——— 1964. Some fruit flies of economic importance in South Africa. *Dep. Agric. Tech. Serv.* 18 pp.

SENIOR WHITE, R. 1922. New species of Diptera from the Indian region. *Mem. Dep. Agric. India (ent. ser.)* **7**(9): 107–169, pls. 11–15.

SPEISER, P. 1915. Beitrage zur Dipterenfauna von Kamerun. III. *Dt.ent.Z.* **1915**: 91–106.

WIEDEMANN, C. R. W. 1818. Neue Insecten vom Vorgebirge der Guten Hoffnung. *Zool, Mag., Kiel* **1**(2): 40–48.

——— 1830. *Aussereuropäische zweiflügelige Insekten* 2, xii + 684 pp. Hamm.

ZAKA-UR-RAB, M. 1960. A new species of the genus *Craspedoxantha* Bezzi, 1913, from India (Diptera: Trypetidae). *J. Bombay Nat. Hist. Soc.* **57**(3): 683–686, 1 pl.

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